REMARKS

Claims 13, 16-21, 23-39, and 42-51 are pending in the case.

Claims 1-12, 14-15, 22, 40-45 have been cancelled.

Claims 46-50 are withdrawn from consideration as being directed to non-elected subject matter.

Thus, Claims 13, 16-21, 23-39, and 42-45, and 51 are under consideration by the Examiner.

Applicants would first like to express appreciation to Examiner Hailey for the courtesies extended to their representative during the discussion of January 10, 2006. During the discussion it was pointed out that the present invention is directed to a catalyst wherein at least said first and second metal components, rhodium and indium, respectively, are predominantly contained in an outer surface layer of the support (the "egg shell" structure). That such a structure would lead to the unexpected results demonstrated in the original specification as filed is not fairly suggested in the prior art of record. The following discussion is intended to summarize and elaborate upon the comments made during the aforementioned discussion of January 10, 2006.

Steam cracking of crude produces the desirable products ethylene, propylene and butene, which are in large measure the building blocks of the petrochemical industry. Acetylene and dienes are also produced, and these are typically undesired products. These undesireable products can be hydrogenated, but a problem is over-hydrogenation to alkanes and "green oil", the latter of which decreases the life of the hydrogenation catalyst. The present invention relates to an improved catalyst, a process for making a catalyst, and (currently withdrawn from consideration) a process for the selective hydrogenation of alkynes and diolefins to olefins using said catalyst. Specifically, the

claims under consideration are directed to (i) a catalyst comprising rhodium and indium and a third metal, different from rhodium and indium and selected from Groups 1 to 15 of the Periodic Table of Elements, wherein at least said first and second metal components are essentially contained in an outer surface layer of the support having a depth of not more than 300 microns; and (ii) a process for making said catalyst.

As discussed and shown during the discussion of January 10, 2005, the present inventors have discovered that properties of supported catalysts useful in selective hydrogenation of acetylenes and diolefins to monoolefins vary significantly depending on the distribution of the metal(s) in the catalyst, and have discovered a distribution that is demonstrably superior to what is fairly suggested by the prior art of record. Depending on preparation technique, the metal(s) may be uniformly distributed throughout the support, can be located within a thin layer at the surface (the "egg shell" structure), can be located at the center of the support (the "egg yolk" structure), or can be concentrated between the outer edge and the center of the support (the "egg white" structure). The present inventors have surprisingly discovered that if at least rhodium and indium are present on the support in the "egg shell" structure, a superior catalyst for selective hydrogenation as set forth *inter alia* in Claim 46 is achieved. This is the catalyst that is claimed in Claim 13 and others. The method of making it is claimed in Claim 36 and others.

Claims 13, 16-21, 25-37, and 42-44 are rejected under 35 USC 103 as being obvious over Uzio et al. (US 6,498,280; hereinafter Uzio) and Claims 13, 16-21, 25-39, and 42-45 are rejected under 35 USC 103 as being obvious over Shepherd et al. (US 6,503,866; hereinafter Shepherd). Applicants urge that neither of these references can possibly suggest the present invention.

Uzio is directed to a catalyst useful for paraffin dehydrogenation comprising, in the examples, platinum, tin, indium, lithium, chlorine. Even catalysts used in the comparative examples comprised these same metals. The detailed description of the invention described in the patent suggests that for the paraffin dehydrogenation catalyst

of the invention any platinum group metal can be used (e.g., although platinum is preferred, rhodium is a possibility), it suggests any Group 13 metal can be used (e.g., indium can be used and is in fact preferred by the reference), it requires a group 14 metal (e.g, tin), an alkali metal (e.g., lithium) and a halogen.

Assuming *arguendo* that one of ordinary skill in the art would select from the teaching of Uzio a selective hydrogenation catalyst comprising rhodium, indium, plus a third metal (different from rhodium or indium), the present claims require that at least rhodium and indium must be present in the "egg shell" structure-type.

Uzio at col. 2, lines 13+, refers, with regard to platinum distribution only, to a prior art catalyst wherein "an excess concentration of active phase on the surface can cause diffusional limitations ...". In contrast, Uzio refers at col. 2, lines 32, again with regard solely to platinum, to "an interest in dispersing the metallic phase to the best extent .... [it] is important to develop a maximum specific metal surface area ...". Uzio is referring to increasing the surface area of the metal, and explicitly not trying to increase the amount of platinum on the eggshell structure of the support! Note also in all the examples "In Accordance with the Invention" set forth in Uzio, the elements are described as being "homogenously distributed in the support beads". See, e.g., col. 6, line 28-29. Clearly, Uzio presents a teaching away from anything other than a uniform distribution, i.e., the reference teaches away from the present claimed invention.

A comparison of the catalyst with the metals in the egg shell structure-type versus distribution throughout the support is shown in Example 3 of the present specification as filed. See especially Table 3, page 22, of the present specification. Catalyst A, evidencing distribution throughout the support, shows much higher over-hydrogenation to the alkanes and significantly (>10%) production of undesirable "green oil" oligomers (green oil also being a catalyst poison).

These arguments with respect to the Uzio rejection were presented during the aforementioned discussion of January 10, 2006, and while no agreement was reached, the argument appeared to be persuasive.

Shepherd is directed to a reduced surface area alumina catalyst with improved crushing strength and prepared using a high temperature calcination step from about 700°C to about 900°C (compare with the present Claim 44, which calls for a calcination from about 100°C to about 600°C).

Shepherd is really interested in the strength of the support, not the active metals, because all of the metals are described as optional! There is an *optional* platinum group metal (which includes the rhodium required in the present invention), an *optional* Group 14 metal (e.g., tin), and a plethora of *optional* catalyst modifiers (including indium), "catalytically effective amounts of [which] may be added in any suitable manner". See col. 5, lines 64+.

With regard to the platinum group metal, the reference states clearly that generally the metal is dispersed homogeneously in the catalyst. It does teach that the platinum group metal may be concentrated in the surface layer, tapering off in progressing to the center of the catalyst particle. See the discussion beginning in the last paragraph of col. 2 of the reference.

The present claims, however, require that at least the rhodium and indium be present in the eggshell structure-type. This is not fairly suggested in the reference. The reference suggests only that the Group 14 metal - e.g., tin - is to be dispersed throughout the porous carrier material" (col. 5, about line 33). It never suggests that any metal other than the platinum group metal be dispersed in the eggshell structure-type (and again, the dispersion of the platinum group metal in the eggshell structure is clearly a secondary choice for the reference).

As discussed above, however, the present specification contains a showing of unexpected results for the egg shell structure-type over uniform dispersion.

Note also that the amended Claim 17 and new Claim 51 require that all three metals be present in the eggshell structure-type.

These arguments with respect to the Shepherd rejection were presented during the aforementioned discussion of January 10, 2006, and while no agreement was reached, the argument appeared to be persuasive.

For the above reasons, it is respectfully requested that the rejections be withdrawn.

Finally, Applicant's respectfully ask for reconsideration of the restriction requirement which removed Claims 46-50 from consideration. At a minimum, since Claim 46 depends from Claim 36 and Claim 47 depends from Claim 1, and Claims 1 and 36 are believed allowable at least for the reasons presented above, we believe these claims should be examined and allowed, on the basis of the above-recited arguments over the references of record.

There being no further issues, Applicants respectfully urge that the present application is in condition for allowance and early indication of such is earnestly solicited.

Respectfully submitted,

30 January 2006
Date

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